

What Is Claimed Is:

1           1. In a method for operating a fuel cell  
2 system having a fuel processor which supplies a hydrogen-  
3 rich stream to a stack of fuel cells, wherein said  
4 hydrogen reacts with an oxidant to supply electrical  
5 power to an external load, the improvement comprising:

6           (a) monitoring actual voltage and actual  
7 current from the fuel cell stack;  
8           (b) determining an expected magnitude of  
9 voltage as a function of said actual  
10 current based on a predetermined  
11 relationship between voltage and current;  
12           (c) calculating a variance value between said  
13 actual voltage and said expected voltage  
14 magnitudes; and  
15           (d) generating a signal if said calculated  
16 variance value exceeds a predetermined  
17 variance value.

1           2. The method of claim 1 wherein before step  
2 (d), establishing different predetermined variance values  
3 for different loads.

1           3. The method of claim 1 wherein before step  
2 (d), establishing different predetermined variance values  
3 for different fuel cell stack operating parameters.

1           4. The method of claim 3 wherein said  
2 different fuel cell stack operating parameters include  
3 pressure, temperature, supply of said hydrogen-rich  
4 stream and supply of said oxidant.

1               5. The method of claim 1 wherein said  
2 predetermined relationship between voltage and current is  
3 symbolized as a polarization curve and wherein different  
4 predetermined variance values are established along the  
5 curve.

1               6. The method of claim 1 further including  
2 terminating the supply of power to the external load when  
3 said predetermined variance value is exceeded.

1               7. The method of claim 1 further comprising  
2 the step of establishing the predetermined variance value  
3 as a percentage of the expected magnitude of the voltage.

1               8. The method of claim 7 further comprising  
2 the steps of:

3                 establishing a positive variance value as a  
4 percentage of the predicted voltage wherein the sum of  
5 percentage and the predicted voltage magnitude are  
6 greater than the predicted voltage magnitude; and

7                 establishing a negative variance value as a  
8 percentage of the predicted voltage magnitude wherein the  
9 sum of the percentage and the predicted voltage magnitude  
10 is less than the predicted voltage magnitude.

1               9. The method of claim 8 further comprising  
2 the step of:

3                 generating separate output signals based on the  
4 predicted voltage magnitude exceeding the positive and  
5 the negative variance values.

1               10. In a method for operating a fuel cell  
2 system having a fuel processor which supplies a hydrogen-  
3 rich stream to a stack of fuel cells, wherein said  
4 hydrogen reacts with an oxidant to supply electrical  
5 power to an external load, the improvement comprising:

- 6                   (a) establishing a predetermined relationship
- 7                   between voltage and current for a fuel
- 8                   cell stack;
- 9                   (b) monitoring actual voltage and actual
- 10                  current from the fuel cell stack;
- 11                  (c) then either:
  - 12                   (1) determining an expected value of
  - 13                   voltage as a function of the actual
  - 14                   current based on the predetermined
  - 15                   relationship; or
  - 16                   (2) determining an expected value of
  - 17                   current as a function of the actual
  - 18                   voltage based on the predetermined
  - 19                   relationship;
- 20                  (d) calculating the variance between said
- 21                  actual and expected values; and
- 22                  (e) generating a signal if the calculated
- 23                  variance exceeds a predetermined variance
- 24                  value.